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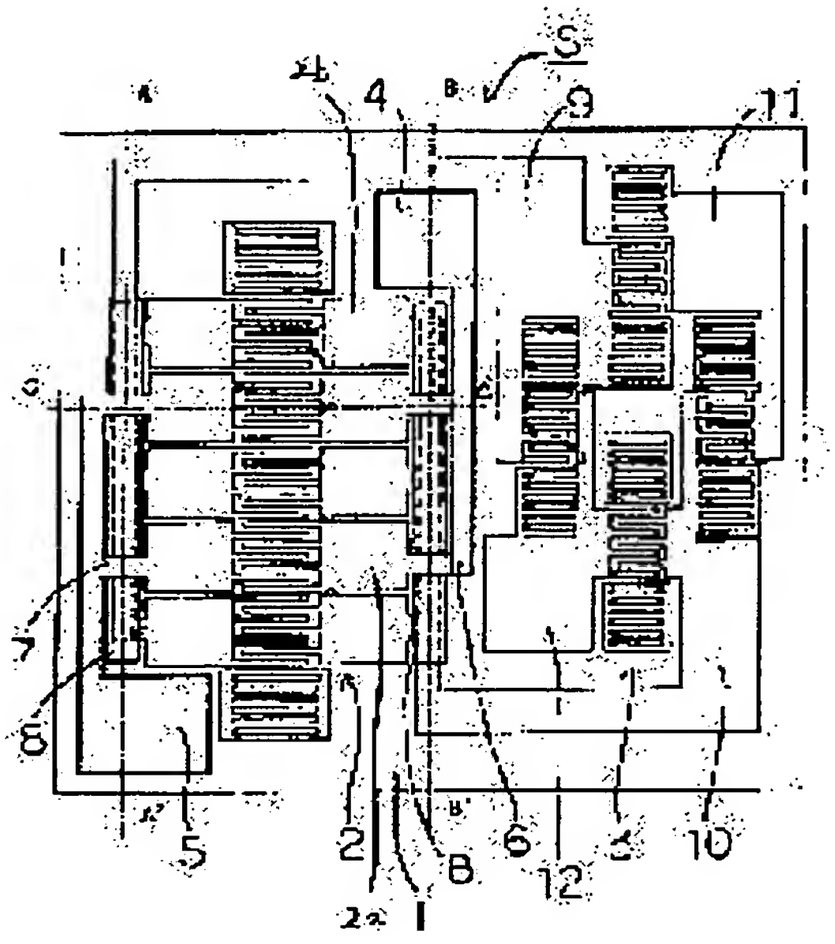
(54) SURFACE ACOUSTIC WAVE FILTER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a surface acoustic wave filter with which a balance type surface acoustic wave filter having reliability to power and smooth pass characteristics in a passband is obtained.

SOLUTION: This acoustic wave filter S is formed by connecting a lattice type circuit 3 that connects surface acoustic wave resonators consisting of plural IDT (comb-shaped) electrodes with one another in a symmetrical lattice shape or a ladder type circuit which connects surface acoustic wave resonators comprising plural IDT electrodes in a ladder shape to the input or output side of an IIDT multi-electrode 2 which alternately provides plural IDT electrodes 2a for input and plural IDT electrodes 2b for output side by side.



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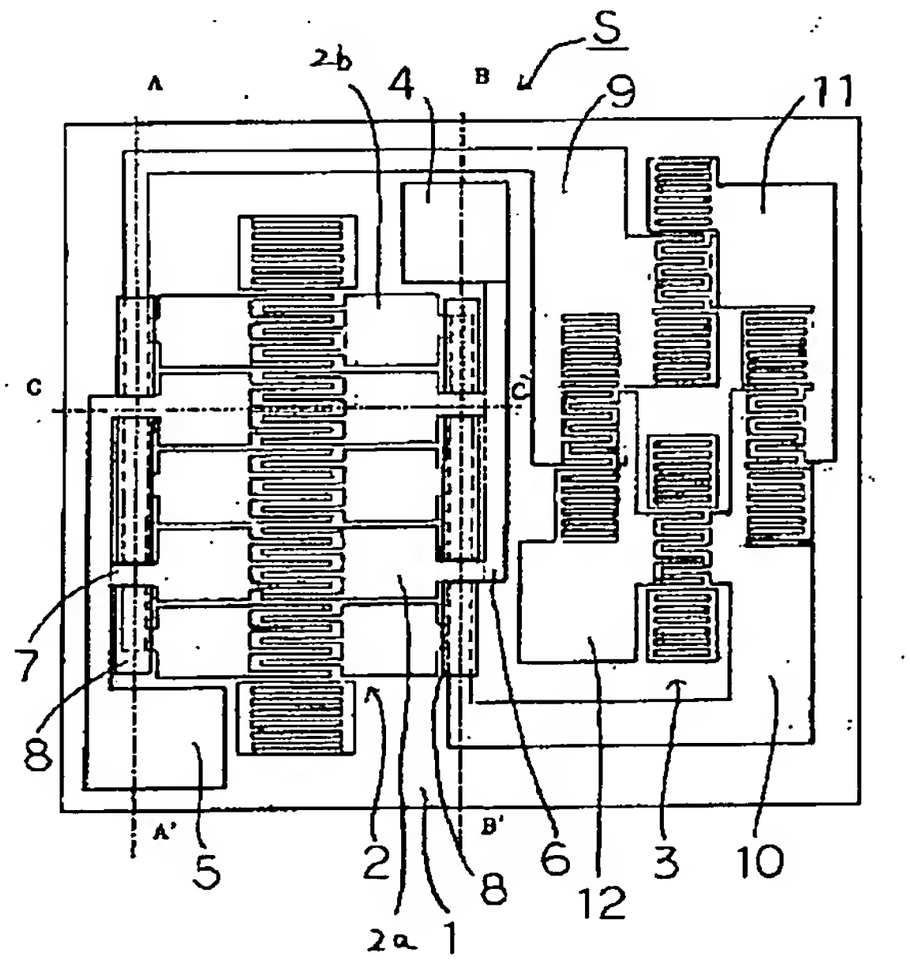
DD29 EE09 FF03 GG01 GG03
GG04 HA02 KK03 KK05 KK09

(54)【発明の名称】弾性表面波フィルタ

(57)【要約】

【課題】　電力に対して信頼性があり、通過帯域の平滑な通過特性である平衡型SAW フィルタを得られる弾性表面波フィルタを提供すること。

【解決手段】　複数の入力用ＩＤＴ電極２ａと複数の出力用ＩＤＴ電極２ｂとを交互に並設したＩＩＤＴ電極２の入力又は出力側に、複数のＩＤＴ電極から成る弾性表面波共振子どうしを対称格子状に接続したラティス型回路３又は複数のＩＤＴ電極から成る弾性表面波共振子を梯子状に接続したラダー型回路に接続して成る弾性表面波フィルタＳとする。



【特許請求の範囲】

【請求項１】　複数の入力用ＩＤＴ電極と複数の出力用ＩＤＴ電極とを交互に並設したＩＩＤＴ電極の入力又は出力側に、複数のＩＤＴ電極から成る弾性表面波共振子どうしを対称格子状に接続したラティス型回路又は複数のＩＤＴ電極から成る弾性表面波共振子を梯子状に接続したラダー型回路に接続して成る弾性表面波フィルタ。

【請求項２】　前記ＩＤＴ電極の電極ピッチの平均値λと電極膜厚ｈとの関係が下記式を満足することを特徴とする請求項１に記載の弾性表面波フィルタ。

６．５％　＜　ｈ／λ　＜　１０．５％

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、自動車電話及び携帯電話等の移動体無線機器に内蔵される周波数帯域フィルタであって、不平衡平衡変換の弾性表面波フィルタに関する。

【０００２】

【従来の技術】従来の弾性表面波（Surface Acoustic Wave で、以下、SAW と略す）装置の基本構成は、一対の櫛歯状電極（Inter Digital Transducerで、以下、IDT電極と略す）を複数若しくは１つ載置し、IDT 電極から励起されるのSAW の伝搬路上に、SAW を効率良く共振させるための反射器が配置される構造となっている。

【０００３】IDT 電極及び反射器は、例えば36° Y カットX 伝搬タンタル酸リチウム単結晶等からなる圧電基板上に、蒸着法、スパッタ法等によりAl、Al-Cu 合金等の導電物がフォトリソグラフィ法により微細な電極となるようにパターンを形成し、作製される。

【０００４】近年、電波を利用し通信を行なう電子機器用の帯域通過フィルタ等の周波数フィルタ（以下、フィルタという）、遅延線、発信器等の電子部品として、多くのSAW 共振子やSAW フィルタが用いられている。特に、移動体通信分野において、携帯電話等の携帯端末装置のRF（Radio Frequency ：無線周波数あるいは高周波）ブロック及び（Intermediate Frequency：中間周波数）ブロックのフィルタとして多用されており、通過帯域の平滑な通過特性に対する要望が強い。

【０００５】また、この移動体通信機器等の小型・軽量化及び低コスト化のための使用部品点数削減により、SAW フィルタに新たな機能の付加が要求されている。その一つに、受送信号の周波数のダウンコンバート及びアップコンバートを行なうミキサICの平衡入出力端に、不平衡入力－平衡出力、平衡入力－不平衡出力の電気接続ができるSAW フィルタ（以下、平衡型SAW フィルタという）が望まれている。

【０００６】また、前記ミキサICにより平衡端で終端される公称抵抗値は変化するため、この抵抗値に合わせて平衡型SAW フィルタの平衡端接続抵抗を設計する必要がある。

【０００７】従来のSAW フィルタの場合、不平衡入力－不平衡出力しかできない接続であるため（例えば、特開平０５－１８３３８０号公報を参照）、SAW フィルタとミキサICの間に、バランと呼ばれる平衡－不平衡変換器を介している。

【０００８】また、上記平衡型SAW フィルタとして、伝搬方向に対してIDT 電極指垂直に並べたIDT 電極を２つまたは３つ並べ、それらの両側に前記反射器を構成させた共振器型SAW フィルタでも平衡入出力対応できるが、この共振器構造ではSAW のエネルギーが共振器の中に蓄積して、特にRFブロックの帯域フィルタを作製するため、IDT 電極の櫛歯のピッチを小さくし、かつRFブロックに印加される電力をかけた場合、電極のマイグレーションによりフィルタ特性が劣化することがあり、部品の信頼性上問題である。

【０００９】

【発明が解決しようとする課題】上記問題点を解消するため、まずSAW フィルタに印加される電力を分散させるため、多数の共振子を用いて構成させた複合共振子型SAW フィルタ構造と、平衡型SAW フィルタとして、IDT 電極を入出力１つ置きに載置したマルチ電極（Inter-degitated Inter Digital Transducerで、以下、IIDT電極と略す）を複合させて構成し、電圧を分散させ耐電力性を向上させる必要がある。

【００１０】また、IIDT電極はIDT 電極の構成が多数であるため、従来から行われていたＡｌワイヤやＡｕワイヤによる配線が複雑であり、このワイヤとＩＩＤＴ電極を接続させるパッド部も多大な面積が必要である。

【００１１】従って、本発明は上記事情に鑑みて、電力に対して信頼性があり、ワイヤ接続の乱雑さを解消し、通過帯域の平滑な通過特性である弾性表面波フィルタを提供することを目的とする。

【００１２】

【課題を解決するための手段】上記課題を解決するため、本発明の弾性表面波フィルタは、複数の入力用ＩＤＴ電極と複数の出力用ＩＤＴ電極とを交互に並設したＩＩＤＴ電極の入力又は出力側に、複数のＩＤＴ電極から成る弾性表面波共振子どうしを対称格子状に接続したラティス型回路又は複数のＩＤＴ電極から成る弾性表面波共振子を梯子状に接続したラダー型回路に接続して成る。

【００１３】また、特にＩＤＴ電極の電極ピッチの平均値λと電極膜厚ｈとの関係が下記式を満足することを特徴とする請求項１に記載の弾性表面波フィルタ。

【００１４】６．５％　＜　ｈ／λ　＜　１０．５％

【００１５】

【発明の実施の形態】本発明に係るSAW フィルタの実施形態を図面に基づき詳細に説明する。

【００１６】弾性表面波フィルタＳの電極構成を図１に示す。１は圧電基板であり、２はIIDT電極であり（入力

用ＩＤＴ電極２ａと出力用ＩＤＴ電極とが交互に並設して成る）、３は格子型（ラティス型回路）に配置したIDT 電極である。４は入力電極は４であり、５は接地電極である。この入力電極４、接地電極５にRF電気信号を加え、シリカ，窒化シリコン，アルミナ等の絶縁薄膜８で絶縁され立体配線された構造を持つIIDT電極２に電気信号が加えられる。

【００１７】ここで、図１におけるＡ－Ａ’，Ｂ－Ｂ’，Ｃ－Ｃ’線断面図を図２（ａ），（ｂ），（ｃ）にそれぞれ示す。

【００１８】上記入力信号は、IIDT電極２のIDT 電極にてSAW に変換され、入力用IDT 電極の両側からSAW が伝搬し、IIDT電極２の出力側の電極に送られる。送られたSAWはIIDT電極２の出力用IDT 電極にて、SAW から電気信号に変換される。

【００１９】この時、出力対をなすIDT 電極の電極指はSAW の半波長毎に周期を持つため、出力された電気信号は平衡信号となる。この平衡信号は立体配線された６，７を通り、IDT 電極の共振子を格子型に構成した３の入力となる９、１０の電極に入力される。

【００２０】格子型に構成した格子型回路３は、直列腕となる共振子では共振周波数付近、格子腕となる共振子では反共振周波数付近が通過帯域となる。

【００２１】このため、３は直列腕となる共振子では共振周波数と格子腕となる共振子では反共振周波数を概略一致させるようにする。このようにIIDT電極および格子型共振子構成により、不平衡信号から平衡信号への変換機能とフィルタリング機能を有することになる。

【００２２】図中では、入力側にIIDT電極、出力側に格子型電極を配置させたが、これが逆の出力側にIIDT電極、入力側に格子型電極を配置させても構わない。また、格子型の替わりにIDT 電極を梯子型（ラティス型回路）に構成させた電極構造を入力側に配置しても構わない。

【００２３】図５に示すように、フィルタの通過域の平坦度を良好にするため、適切な電極膜厚が存在することが判った。図の帯域内偏差は、通過域内の最小挿入損失から最大挿入損失を差し引いた値であり、通過域の平坦度を示し、小さければ良好な特性であることがいえる。帯域内偏差が良好な電極膜厚比（電極膜厚をIDT 電極の周期長で割った値）は、IIDT電極では７％程度、格子構造では９％程度、梯子構造では９％程度であり、これらの複合させた本発明の構造では６．５％から１０．５％が良好な範囲であることが判った。

【００２４】なお、ＳＡＷフィルタ用の圧電基板として、36° ±３° Y カットX 伝搬タンタル酸リチウム単結晶、42° ±３° Y カットX 伝搬タンタル酸リチウム単結晶、64° ±３° Y カットX 伝搬ニオブ酸リチウム単結晶、41° ±３° Y カットX 伝搬ニオブ酸リチウム単結晶、45° ±３° Ｘカット Ｚ伝搬四ホウ酸リチウム単結晶

は電気機械結合係数が大きく且つ周波数温度係数が小さいため好ましい。

【００２５】また、圧電基板の厚みは０．１～０．５mm程度が良く、０．１mm未満では圧電基板が脆くなり、０．５mm超では材料コストと部品寸法が大きくなり、使用できない。

【００２６】また、ＩＤＴ電極及び反射器は、Al若しくはAl合金（Al-Cu 系、Al -Ti系等）から成り、蒸着法、スパッタリング法、またはCVD 法等の薄膜形成法により形成する。そして、IDT 電極は、対数３０～２００対程度、IDT 電極ピッチは０．４ミクロン～２０ミクロン程度、交差幅（開口幅）は１０ミクロン～５００ミクロン程度、IDT 電極厚みは０．１ミクロン～０．５ミクロン程度とすることがSAWフィルタとしての特性を得る上で好適である。

【００２７】また、本発明のSAW フィルタ素子の電極及び圧電基板上のＳＡＷ伝搬部にSi、SiO2、SiN 、Al2O3を保護膜として形成して、導電性異物による通電防止や耐電力向上を行っても構わない。

【００２８】本発明は上記の実施形態に限定されるものでなく、SAW フィルタだけでなく、SAW デュプレクサにも本発明が適用でき、本発明の要旨を逸脱しない範囲で種々の変更は何等差し支えない。

【００２９】

【実施例】図１に示したように入力側にIIDT電極型を出力側に格子接続の共振子を配置させ、これらの配線は図１の６、７の構造によりワイヤによる配線を簡便化した設計を行った。

【００３０】IIDT電極の電極線幅は１．１ミクロンであり、格子型に構成された直列腕共振子のＩＤＴ電極の線幅は１．０５ミクロンであり、また格子腕共振子のＩＤＴ電極の線幅は１．１ミクロンとした。また、電極膜厚は３２００オングストロームであり、全櫛歯状電極ピッチの平均値λと櫛歯状電極の電極膜厚ｈとの比は７．４％とした。

【００３１】具体的な作製方法を、以下に説明する。

【００３２】４２° YカットX 伝搬タンタル酸リチウム単結晶から成る圧電基板上に、前記構造、前記共振子電極詳細を網羅する回路パターンを形成することにより作製した。まず洗浄した基板にレジストを約１ミクロンの膜厚で塗布し、窒素雰囲気中でベークを行った。

【００３３】次に、紫外線(Deep-UV) を用いた密着露光機によるフォトリソグラフィー法により基板上に多数のSAW フィルタのレジストのネガパターンを形成した。この時、フォトマスクは厚み0.25インチのものを使用した。次にネガパターン上に電子ビーム蒸着機でAlを成膜した。

【００３４】その後、レジスト剥離液中で不要なAlをリフトオフし、IDT 電極等の微細な回路パターンを作製した。その後、IDT 電極をネットワークアナライザに接続

し、挿入損失の周波数特性を測定した。その結果、図４に示すように、帯域内偏差は１．２ｄB と良好な特性を得られた。比較のため、通常のＩＩＤＴ電極構造でのフィルタ特性を図３に示す。この図に示すように、通常のＩＩＤＴ電極構造では通過域近傍に所望しない通過特性（スプリアス）が現れてしまうが、本実施例によれば、図４に示すようにスプリアスは抑圧され良好な特性が得られた。

【００３５】

【発明の効果】以上詳述したように、本発明の弾性表面波フィルタによれば、電力に対して信頼性があり、ワイヤ接続の乱雑さを解消できる平衡型SAW フィルタが実現できる。特にＩＤＴ電極の電極ピッチの平均値λと櫛歯状電極の電極膜厚ｈとの関係が６．５％　＜　ｈ／λ　＜　１０．５％となるように設計することにより、通過帯域の平滑な通過特性である優れた平衡型SAW フィルタを提供できる。

【００３６】さらに、平衡－不平衡変換回路を用いることなく高周波回路を平衡回路化することができるので、部品点数の削減等を実現し小型化が可能な優れた弾性表面波フィルタを提供できる。

【図面の簡単な説明】

【図１】本発明に係る弾性表面波フィルタを説明する平面図である。

【図２】（ａ）は図１のＡ－Ａ’線概略断面図、（ｂ）は図１のＢ－Ｂ’線概略断面図、（ｃ）は図１のＣ－Ｃ’線概略断面図である。

【図３】従来のＩＩＤＴ電極型の弾性表面波フィルタの電気特性を示す線図である。

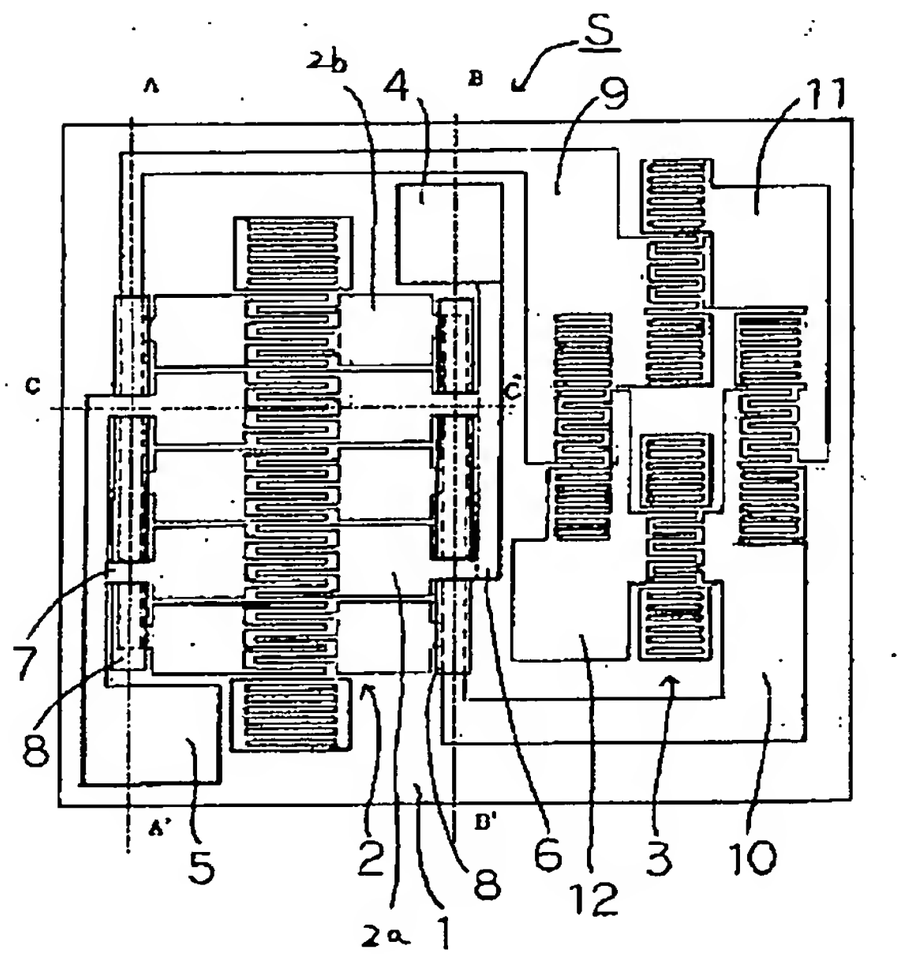
【図４】本発明の弾性表面波フィルタの電気特性を示す線図である。

【図５】各種タイプの弾性表面波フィルタの電極膜厚比と帯域内偏差との関係を示す線図である。

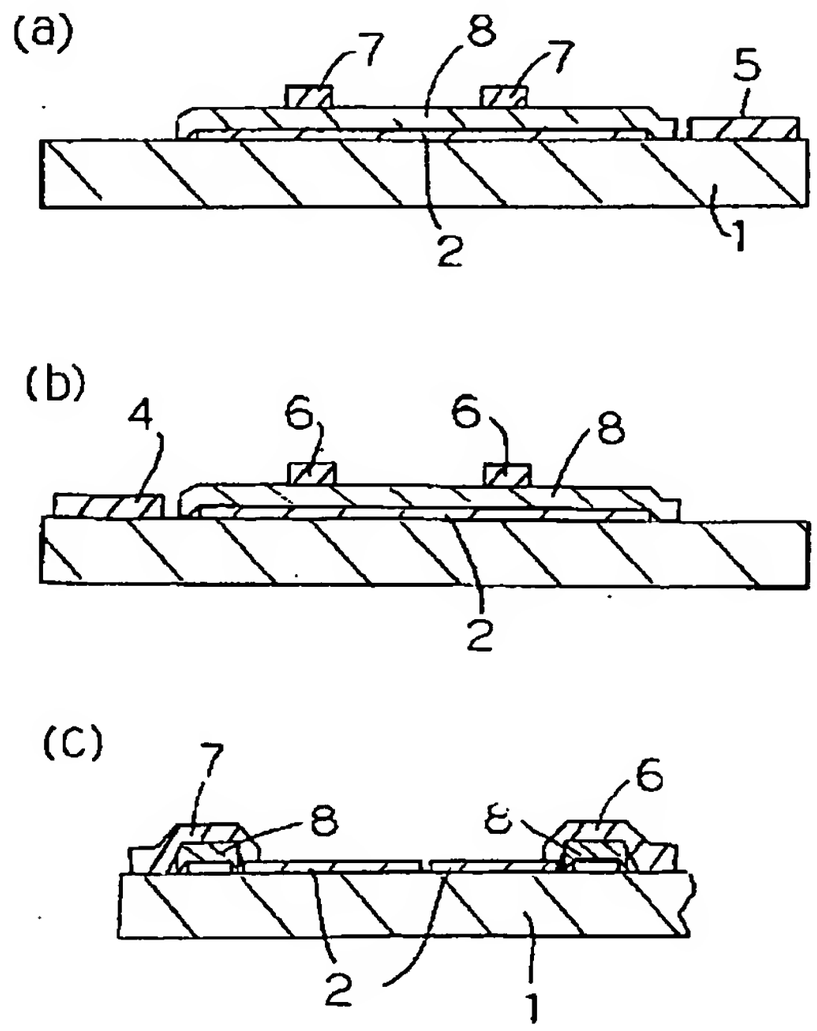
【符号の説明】

１：圧電基板
２：ＩＩＤＴ電極
３：格子型電極
４：入力電極
５：接地電極
６：入力側立体配線部
７：接地側立体配線部
８：絶縁体薄膜
９：格子型電極の入力電極１
１０：格子型電極の入力電極２
１１：平衡出力対の一方の電極
１２：平衡出力対の他方の電極
Ｓ：弾性表面波フィルタ

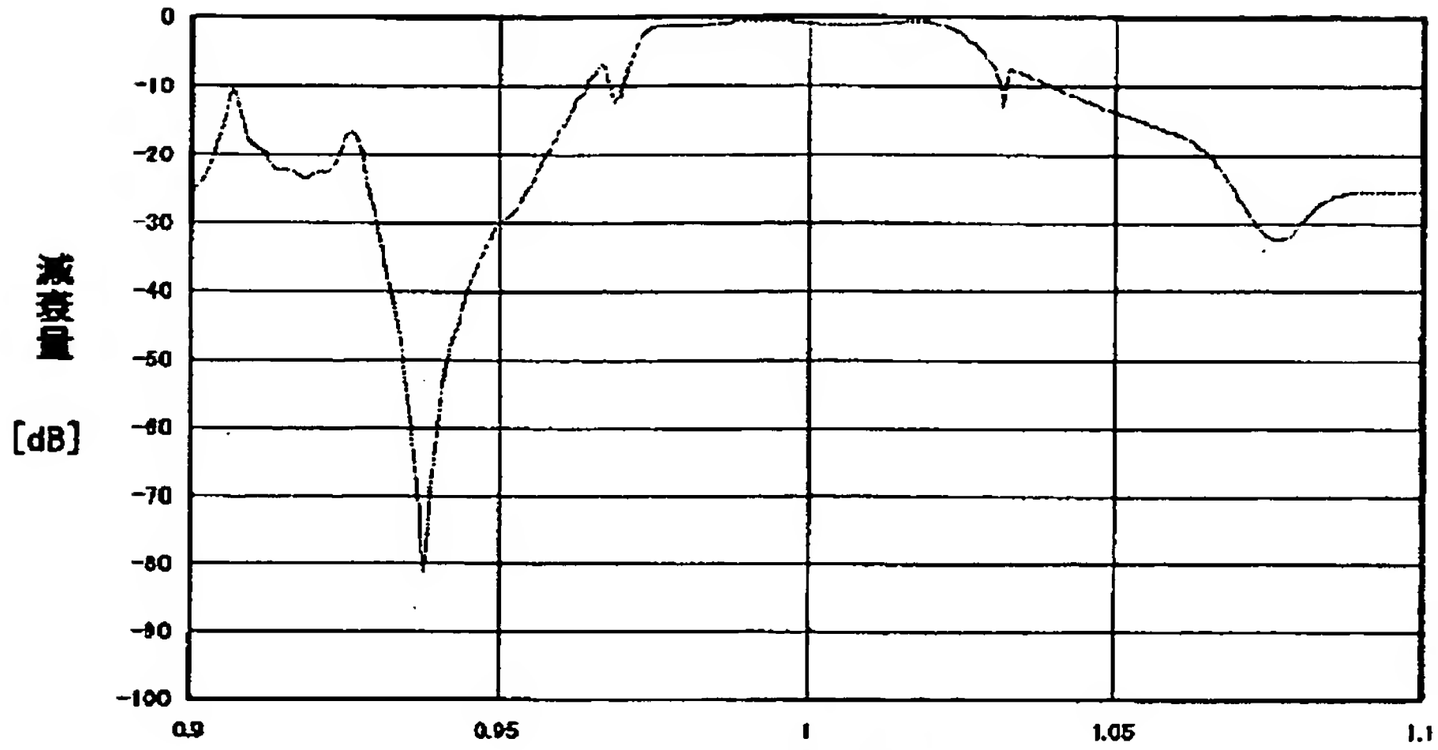
【図１】



【図２】



【図３】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-20
-30
-40
-50
-60
-70
-80
-90
-100
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[dB]
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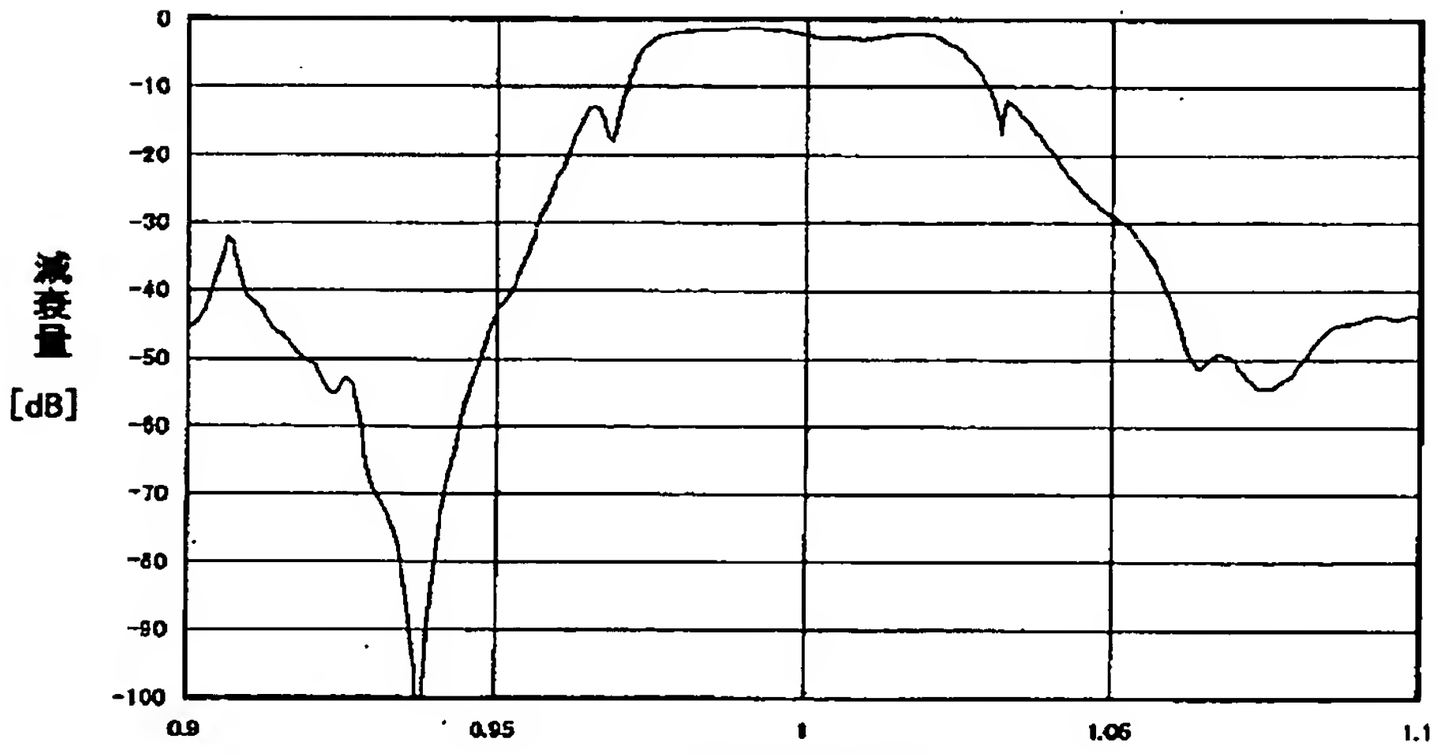
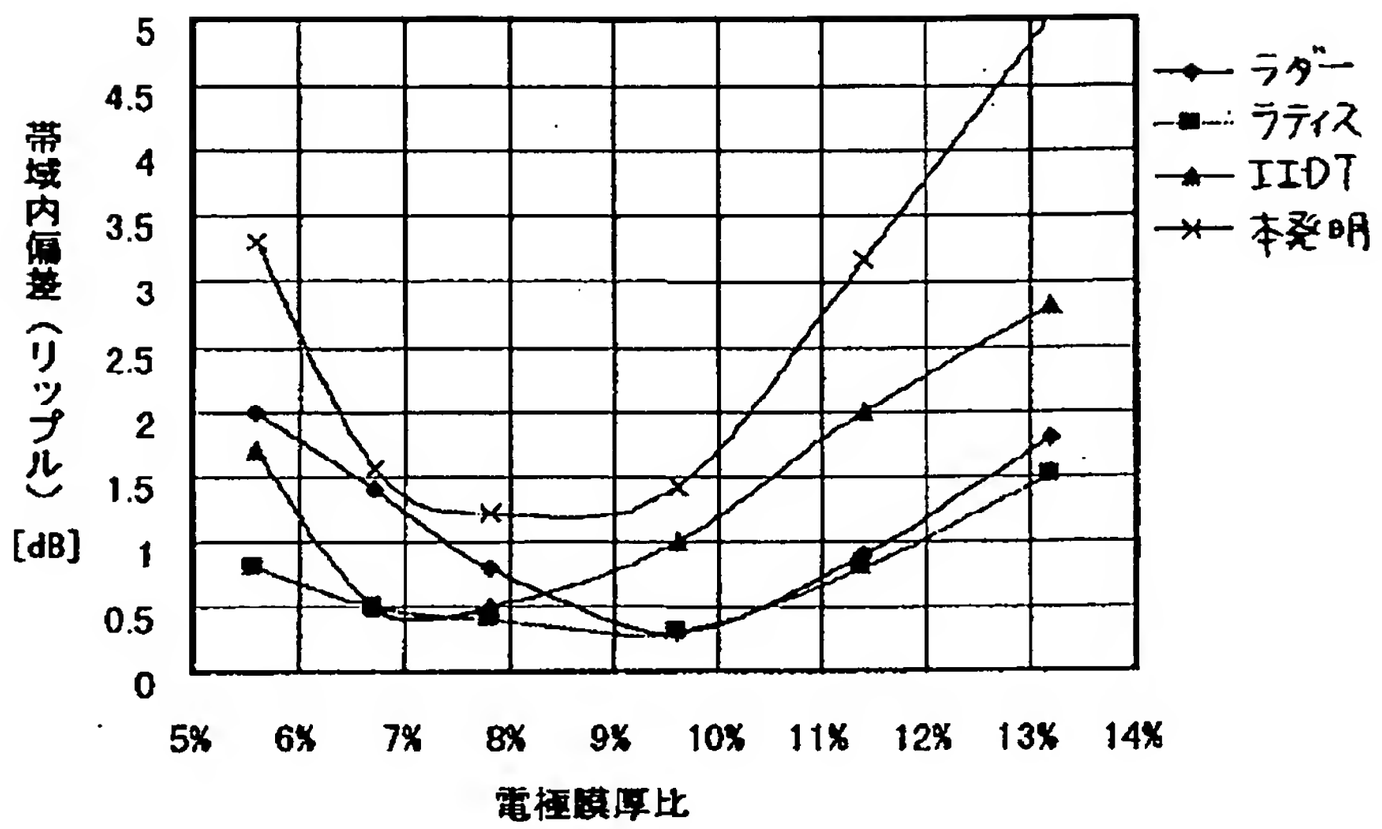
0.95
1
1.05
1.1
規格化周波数

【図４】


0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
減衰量
[dB]
0.9
0.95
1
1.05
1.1
規格化周波数

【図５】


帯域内偏差（リップル）
[dB]
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
5%
6%
7%
8%
9%
10%
11%
12%
13%
14%
電極膜厚比
ラダー
ラティス
IIDT
本発明

PATENT ABSTRACTS OF JAPAN

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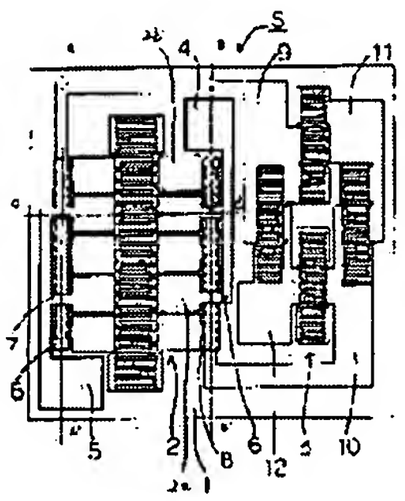
(21)Application number : 10-218313 (71)Applicant : KYOCERA CORP

(22)Date of filing : 31.07.1998 (72)Inventor : OTSUKA KAZUHIRO

(54) SURFACE ACOUSTIC WAVE FILTER



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a surface acoustic wave filter with which a balance type surface acoustic wave filter having reliability to power and smooth pass characteristics in a passband is obtained.

SOLUTION: This acoustic wave filter S is formed by connecting a lattice type circuit 3 that connects surface acoustic wave resonators consisting of plural IDT (comb-shaped) electrodes with one another in a symmetrical lattice shape or a ladder type circuit which connects surface acoustic wave resonators comprising

plural IDT electrodes in a ladder shape to the input or output side of an IIDT multi-electrode 2 which alternately provides plural IDT electrodes 2a for input and plural IDT electrodes 2b for output side by side.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The surface acoustic wave filter which connects and grows into the input or output side of an IIDT electrode which installed two or more IDT electrodes for an input, and two or more IDT electrodes for an output by turns in the ladder mold circuit which connected the surface acoustic wave resonator which consists of the lattice mold circuit or two or more IDT electrodes which connected the surface acoustic wave resonators which consist of two or more IDT electrodes in the shape of a symmetry grid in the shape of a ladder.

[Claim 2] The surface acoustic wave filter according to claim 1 characterized by the average lambda of the electrode pitch of said IDT electrode and relation with the electrode layer thickness h satisfying the following type.

6.5% < -- H/lambda < -- 10.5%

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is a frequency band filter built in mobile wireless devices, such as a land mobile radiotelephone and a cellular phone, and relates to the surface acoustic wave filter of unbalance balance conversion.

[0002]

[Description of the Prior Art] the basic configuration of conventional surface acoustic wave (by Surface Acoustic Wave, it abbreviates to SAW hereafter) equipment -- the ctenidium-like electrode (it is Inter Digital Transducer and they are the following and IDT it abbreviates to an electrode) of a pair -- plurality or one -- laying -- IDT Are excited [SAW] from an electrode. a propagation path top -- SAW It has the structure where the reflector for making it resonate efficiently is arranged.

[0003] IDT An electrode and a reflector are 36degreeY. Cut X On the piezo-electric substrate which consists of a propagation lithium tantalate single crystal etc., they are aluminum and aluminum-Cu by vacuum deposition, a spatter, etc. A pattern is formed and it is produced so that electric conduction objects, such as an alloy, may serve as a detailed electrode by the photolithography method.

[0004] They are many SAW(s) as electronic parts, such as frequency filters (henceforth a filter), such as a band-pass filter for electronic equipment which communicates by using an electric wave in recent years, the delay line, and a transmitter. A resonator and SAW The filter is used. Especially, in the mobile communications field, it is used abundantly as a filter of RF (Radio Frequency : radio frequency or high frequency) block of personal digital assistant equipments, such as a cellular phone, and (Intermediate Frequency: intermediate frequency) a block, and the request to the smooth passage property of a passband is strong.

[0005] Moreover, it is SAW by the use components mark reduction for small and lightweight-izing of this mobile communication equipment etc., and low-cost-izing. Addition of a new function is demanded of the filter. SAW by which electrical

connection of an unbalanced input-balanced output and a balanced input-unbalanced output is made at the balanced I/O edge of the mixer IC which performs a down convert and rise convert of the frequency of a carrier transmitting number to one of them A filter (the following and balanced type SAW it is called a filter) is desired.

[0006] Moreover, in order to change, it doubles with this resistance, and the rated resistance by which termination is carried out at a balanced edge with said mixer IC is a balanced type SAW. It is necessary to design balanced end connection resistance of a filter.

[0007] The conventional SAW Since it is the connection which can perform only an unbalanced input-unbalanced output in the case of a filter (see JP,05-183380,A), it is SAW. Balanced - unbalance converter called a balun between a filter and Mixer IC is minded.

[0008] Moreover, the above-mentioned balanced type SAW As a filter, it is IDT to the propagation direction. IDT arranged in the electrode finger perpendicular It is two or the resonator mold SAW which three were put [mold] in order and made those both sides constitute said reflector about an electrode. Although a filter can also carry out balanced I/O correspondence At this resonator structure, it is SAW. In order that energy may be accumulated into a resonator and may produce especially the band-pass filter of RF block, IDT When the power which makes the pitch of the ctenidium of an electrode small and is impressed to RF block is applied, a filter shape may deteriorate by the migration of an electrode and it is the dependability top problem of components.

[0009]

[Problem(s) to be Solved by the Invention] In order to cancel the above-mentioned trouble, it is SAW first. Compound resonator mold SAW made to constitute using many resonators in order to distribute the power impressed to a filter Filter structure and balanced type SAW As a filter, it is IDT. It is necessary to compound the multi-electrode (for it to abbreviate to an IIDT electrode hereafter by Inter-degitated Inter Digital Transducer) which laid the electrode

every other I/O, to constitute, and to distribute an electrical potential difference, and it necessary to raise power-proof nature.

[0010] Moreover, an IIDT electrode is IDT. Wiring with aluminum wire and Au wire which much configurations of an electrode came out and were performed from the former for a certain reason is complicated, and area also with the great pad section which connects an IIDT electrode to this wire is required.

[0011] Therefore, this invention is reliable to power in view of the above-mentioned situation, the randomness of wire connection is canceled, and it aims at offering the surface acoustic wave filter which is the smooth passage property of a passband.

[0012]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the surface acoustic wave filter of this invention connects and grows into the input or the output side of an IIDT electrode which installed two or more IDT electrodes for an input, and two or more IDT electrodes for an output by turns in the ladder mold circuit which connected the surface acoustic wave resonator which consists of the lattice mold circuit or two or more IDT electrodes which connected the surface acoustic wave resonators which consist of two or more IDT electrodes in the shape of a symmetry grid in the shape of a ladder.

[0013] Moreover, the surface acoustic wave filter according to claim 1 characterized by the average lambda of the electrode pitch of an IDT electrode and relation with the electrode layer thickness h satisfying the following type especially.

[0014] 6.5% < -- H/lambda < -- 10.5% [0015]

[Embodiment of the Invention] SAW concerning this invention The operation gestalt of a filter is explained to a detail based on a drawing.

[0016] The electrode configuration of the surface acoustic wave filter S is shown in drawing 1 . It is IDT which 1 is a piezo-electric substrate, and 2 is an IIDT electrode (IDT electrode 2a for an input and the IDT electrode for an output install by turns, and change), and has arranged 3 to the skeleton pattern (lattice

mold circuit). It is an electrode. An input electrode of 4 is 4 and 5 is an earth electrode. RF electrical signal is added to this input electrode 4 and an earth electrode 5, and an electrical signal is added to the IIDT electrode 2 with the structure by which solid wiring was insulated and carried out with the insulating thin films 8, such as a silica, silicon nitride, and an alumina.

[0017] here -- drawing 1 -- it can set -- A-A -- ' -- B-B -- ' -- C-C -- ' -- a line -- a sectional view -- drawing 2 (a), (b), and (c) -- respectively -- being shown .

[0018] The above-mentioned input signal is IDT of the IIDT electrode 2. It is SAW with an electrode. It is changed and is IDT for an input. The both sides of an electrode to SAW It spreads and is sent to the electrode of the output side of the IIDT electrode 2. sent SAW -- IDT for an output of the IIDT electrode 2 an electrode -- SAW from -- it is changed into an electrical signal.

[0019] IDT which makes an output pair at this time The electrode finger of an electrode is SAW. Since it has a period for every half-wave length, the outputted electrical signal turns into a balanced signal. This balanced signal passes along 6 by which solid wiring was carried out, and 7, and is IDT. It is inputted into 9 or 10 electrodes used as the input of 3 which constituted the resonator of an electrode in the skeleton pattern.

[0020] In the resonator which serves as near resonance frequency and a grid arm in the resonator from which the skeleton pattern circuit 3 constituted in the skeleton pattern serves as a serial arm, near antiresonant frequency serves as a passband.

[0021] For this reason, 3 is made to carry out outline coincidence of the antiresonant frequency in the resonator which serves as resonance frequency and a grid arm in the resonator used as a serial arm. Thus, by the IIDT electrode and the skeleton pattern resonator configuration, it will have the conversion function and filtering function from an unbalance signal to a balanced signal.

[0022] All over drawing, although the IIDT electrode is arranged to the input side and the skeleton pattern electrode was arranged to the output side, this may arrange an IIDT electrode to a reverse output side, and may arrange a skeleton

pattern electrode to an input side. Moreover, it is IDT instead of a skeleton pattern. The electrode structure where the ladder mold (lattice mold circuit) was made to constitute an electrode may be arranged to an input side.

[0023] As shown in drawing 5 , in order to make display flatness of the pass band of a filter good, it turned out that suitable electrode layer thickness exists. It is the value which deducted the maximum insertion loss from the minimum insertion loss of the area within passage, the deflection in a band of drawing shows the display flatness of a pass band, and if small, it can say that it is a good property. In the IIDT electrode, it turned out that the electrode layer thickness ratio (it is IDT about electrode layer thickness value broken by cycle length of an electrode) with the good deflection in a band is about 9% with about 9% and ladder structure, and is range where 10.5% is good from 6.5% with the structure of these compounded this inventions in about 7% and grids structure.

[0024] In addition, it is 36degree**3degreeY as a piezo-electric substrate for SAW filters. Cut X A propagation lithium tantalate single crystal and 42degree**3degreeY Cut X A propagation lithium tantalate single crystal and 64degree**3degreeY Cut X A propagation lithium niobate single crystal and 41degree**3degreeY Cut X Since [that an electromechanical coupling coefficient is large and] a propagation lithium niobate single crystal and a 45-degreeX [**3 degree] cut Z propagation tetraboric-acid lithium single crystal have the small frequency temperature coefficient, they are desirable.

[0025] Moreover, the thickness of a piezo-electric substrate has about 0.1-0.5 goodmm, and by less than 0.1mm, a piezo-electric substrate cannot become weak, by 0.5mm **, ingredient cost and a components dimension become large and it cannot be used.

[0026] Moreover, an IDT electrode and a reflector consist of aluminum or aluminum alloy (aluminum-Cu a system, aluminum-Ti system, etc.), and are vacuum deposition, the sputtering method, or CVD. It forms by the thin film forming methods, such as law. And IDT An electrode is about 30-200 pairs of logarithms, and IDT. An electrode pitch is 0.4 microns - about 20 microns, and

crossover width of face (aperture width) is 10 microns - about 500 microns and IDT. Electrode thickness is suitable when considering as 0.1 microns - about 0.5 microns acquires the property as an SAW filter.

[0027] Moreover, SAW of this invention They are Si, Si02, SiN, and aluminum 2O3 to the SAW propagation section on the electrode of a filter element, and a piezo-electric substrate. It may form as a protective coat and the energization prevention and the improvement in power-proof by the conductive foreign matter may be performed.

[0028] It is not limited to the above-mentioned operation gestalt, and this invention is SAW. Not only a filter but SAW Being able to apply this invention to a duplexer, modification various in the range which does not deviate from the summary of this invention does not interfere at all.

[0029]

[Example] Arranging the resonator of the grid connection of an IIDT electrode mold with an output side to the input side, as shown in drawing 1 , these wiring performed the design which facilitated wiring with a wire according to 6 of drawing 1 R> 1, and the structure of 7.

[0030] The electrode line breadth of an IIDT electrode is 1.1 microns, and the line breadth of the IDT electrode of the serial arm resonator constituted by the skeleton pattern is 1.05 microns, and line breadth of the IDT electrode of a grid arm resonator was made into 1.1 microns. Moreover, electrode layer thickness is 3200A and the average lambda of a total ctenidium-like electrode pitch and the ratio with the electrode layer thickness h of a ctenidium-like electrode could be 7.4%.

[0031] The concrete production approach is explained below.

[0032] 42 degree Y cut X It produced by forming the circuit pattern which covers said structure and said resonator electrode detail on the piezo-electric substrate which consists of a propagation lithium tantalate single crystal. The resist was applied to the substrate washed first by about 1-micron thickness, and BEKU was performed in nitrogen-gas-atmosphere mind.

[0033] Next, ultraviolet rays (Deep-UV) They are much SAW(s) on a substrate by the photolithography method by the used adhesion exposure machine. The negative pattern of the resist of a filter was formed. At this time, the photo mask used the thing with a thickness of 0.25 inches. Next, aluminum was formed with the electron-beam-evaporation machine on the negative pattern.

[0034] Then, lift off of the unnecessary aluminum is carried out in resist exfoliation liquid, and it is IDT. Detailed circuit patterns, such as an electrode, were produced. Then, IDT The electrode was connected to the network analyzer and the frequency characteristics of an insertion loss were measured. Consequently, as shown in drawing 4 , the deflection in a band is 1.2dB. The good property was able to be acquired. The filter shape in the usual IIDT electrode structure is shown in drawing 3 for a comparison. As shown in this drawing, with the usual IIDT electrode structure, the passage property (spurious) for which it does not ask near the pass band will appear, but according to this example, as shown in drawing 4 , spurious one was oppressed and the good property was acquired.

[0035]

[Effect of the Invention] Balanced type SAW which according to the surface acoustic wave filter of this invention it is reliable to power and can cancel the randomness of wire connection as explained in full detail above A filter is realizable. especially -- the average lambda of the electrode pitch of an IDT electrode, and relation with the electrode layer thickness h of a ctenidium-like electrode -- 6.5% < -- H/lambda < -- Outstanding balanced type SAW which is the smooth passage property of a passband by designing so that it may become 10.5% A filter can be offered.

[0036] Furthermore, since a RF circuit can be balanced-circuit-ized, without using balanced - unbalance conversion circuit, reduction of components mark etc. is realized and the outstanding surface acoustic wave filter which can be miniaturized can be offered.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a top view explaining the surface acoustic wave filter concerning this invention.

[Drawing 2] (a) is [the B-B' line outline sectional view of drawing 1 and (c of the A-A' line outline sectional view of drawing 1 and (b))] the C-C' line outline sectional views of drawing 1 .

[Drawing 3] It is the diagram showing the electrical property of the surface acoustic wave filter of the conventional IIDT electrode mold.

[Drawing 4] It is the diagram showing the electrical property of the surface acoustic wave filter of this invention.

[Drawing 5] It is the diagram showing the relation between the electrode layer thickness ratio of the surface acoustic wave filter of various types, and the deflection in a band.

[Description of Notations]

1: A piezo-electric substrate

2: IIDT electrode

3: Skeleton pattern electrode

4: Input electrode

5: Earth electrode

6: Input-side solid wiring section

7: Earth side solid wiring section

8: Insulator thin film

9: The input electrode 1 of a skeleton pattern electrode

10: The input electrode 2 of a skeleton pattern electrode

11: One electrode of a balanced output pair

12: The electrode of another side of a balanced output pair

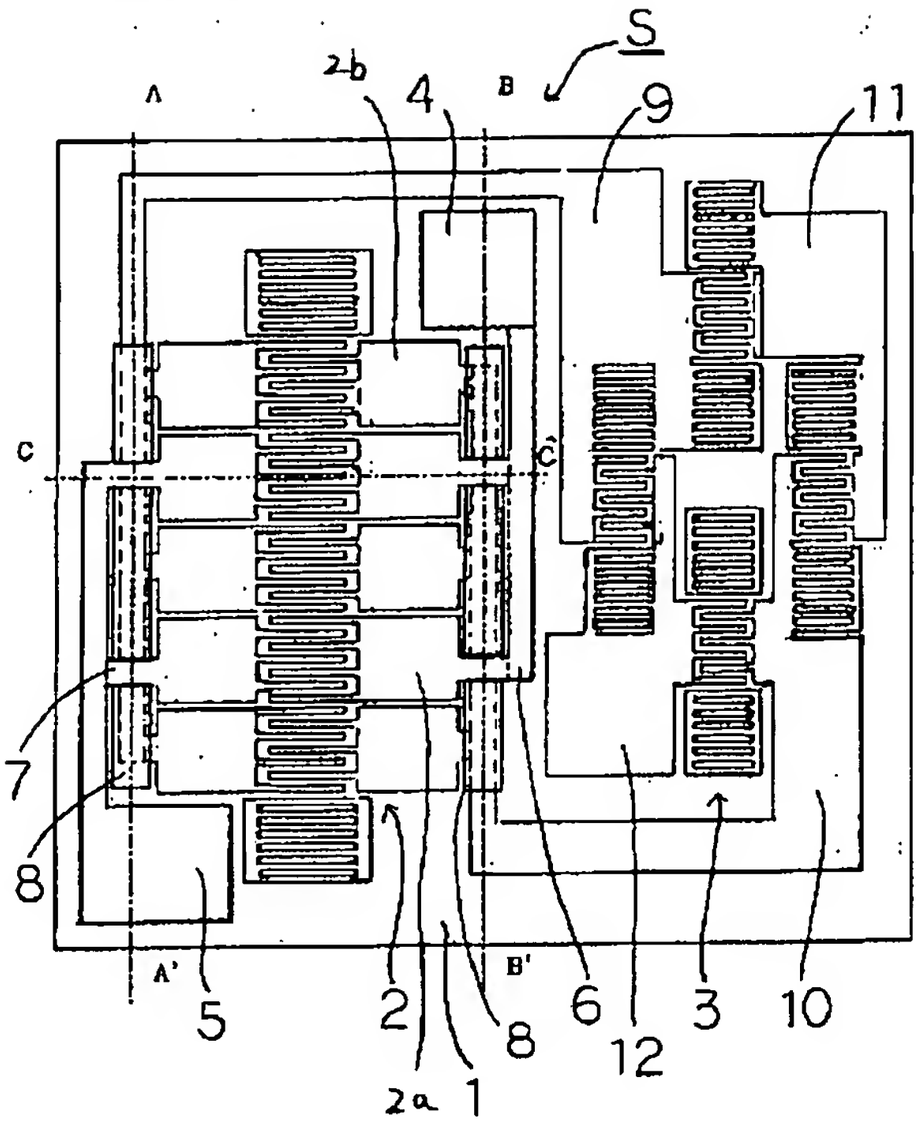
S: Surface acoustic wave filter

[Translation done.]

* NOTICES *

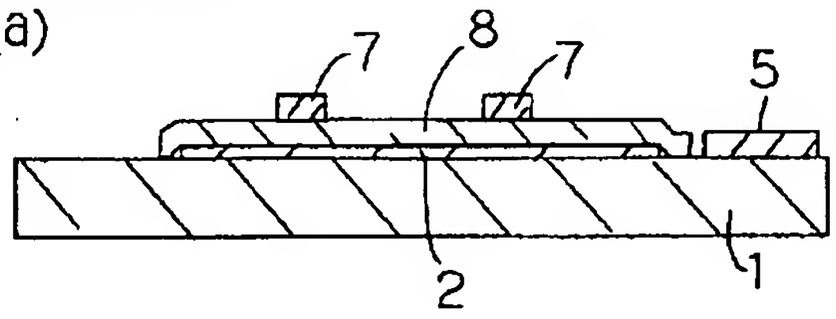
DRAWINGS

[Drawing 1]

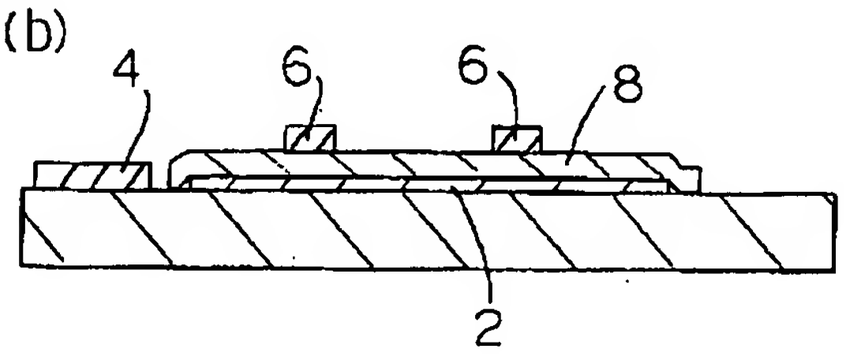


[Drawing 2]

(a)



(b)



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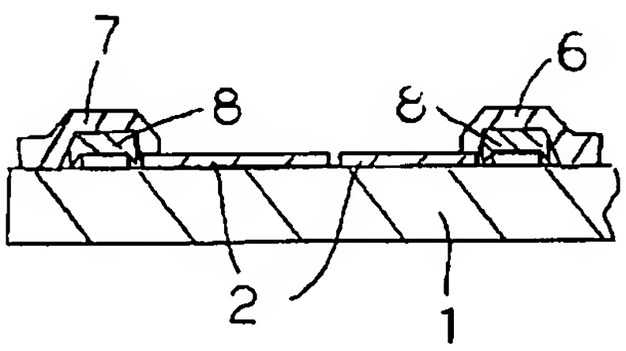
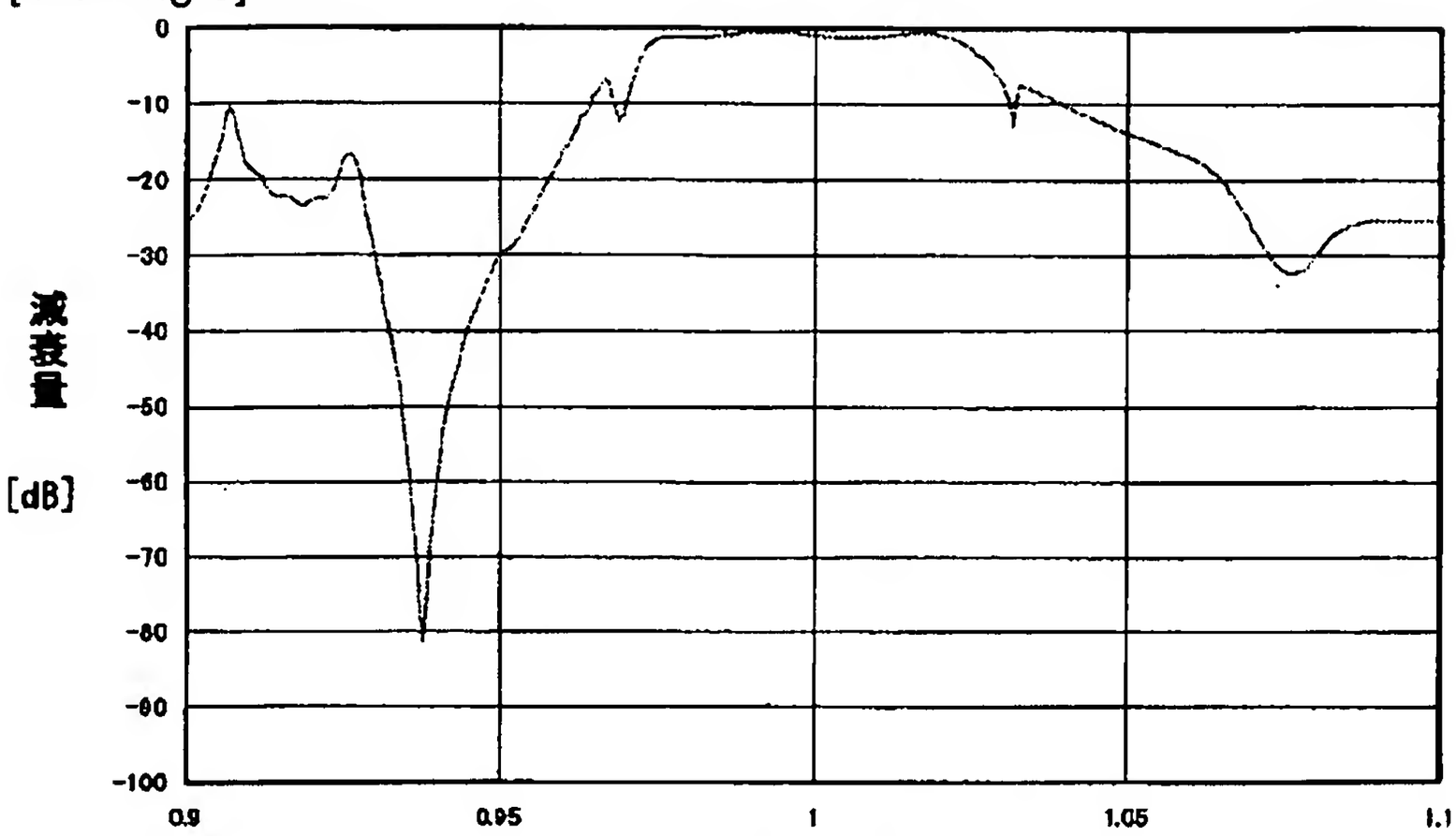
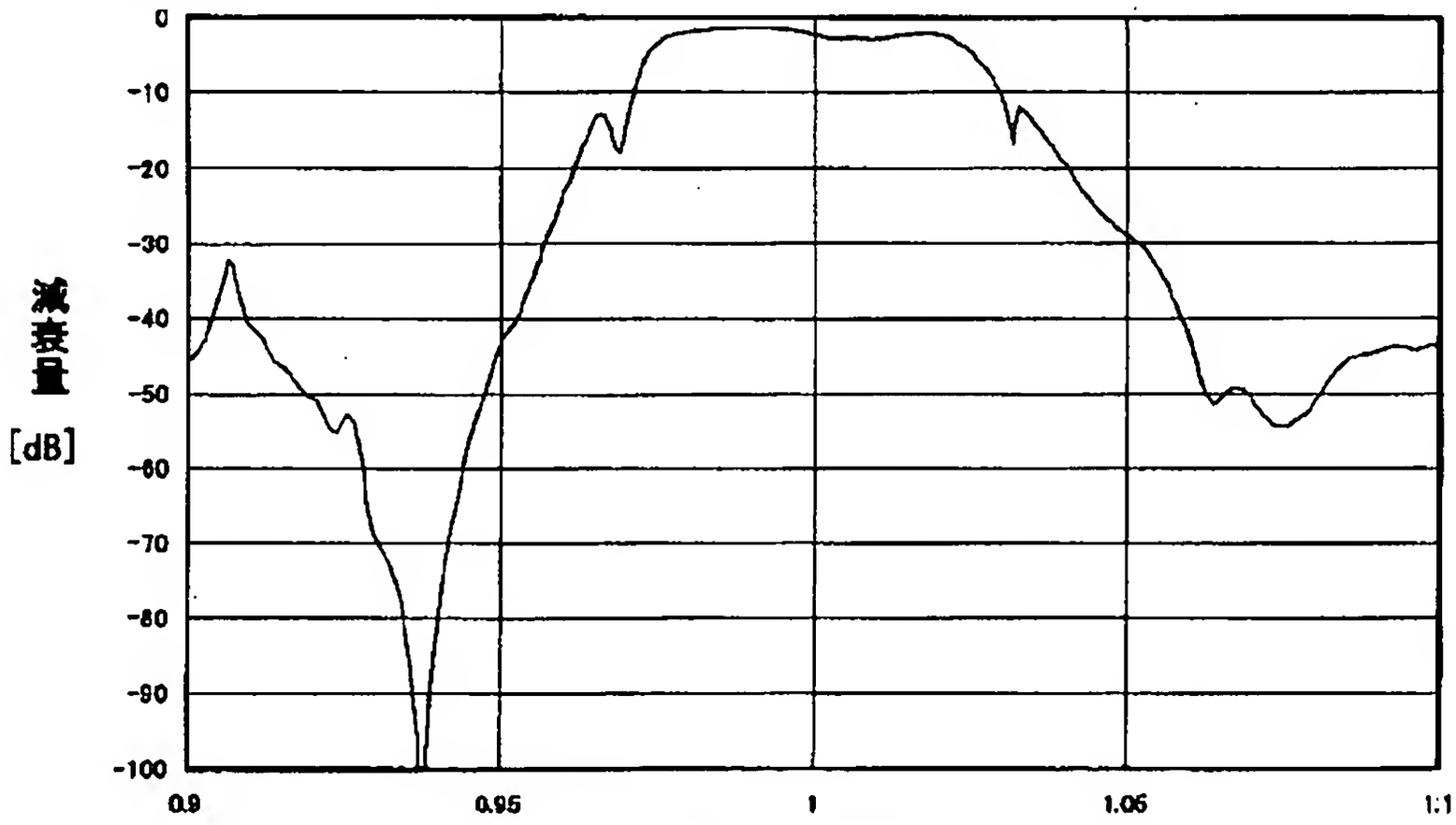


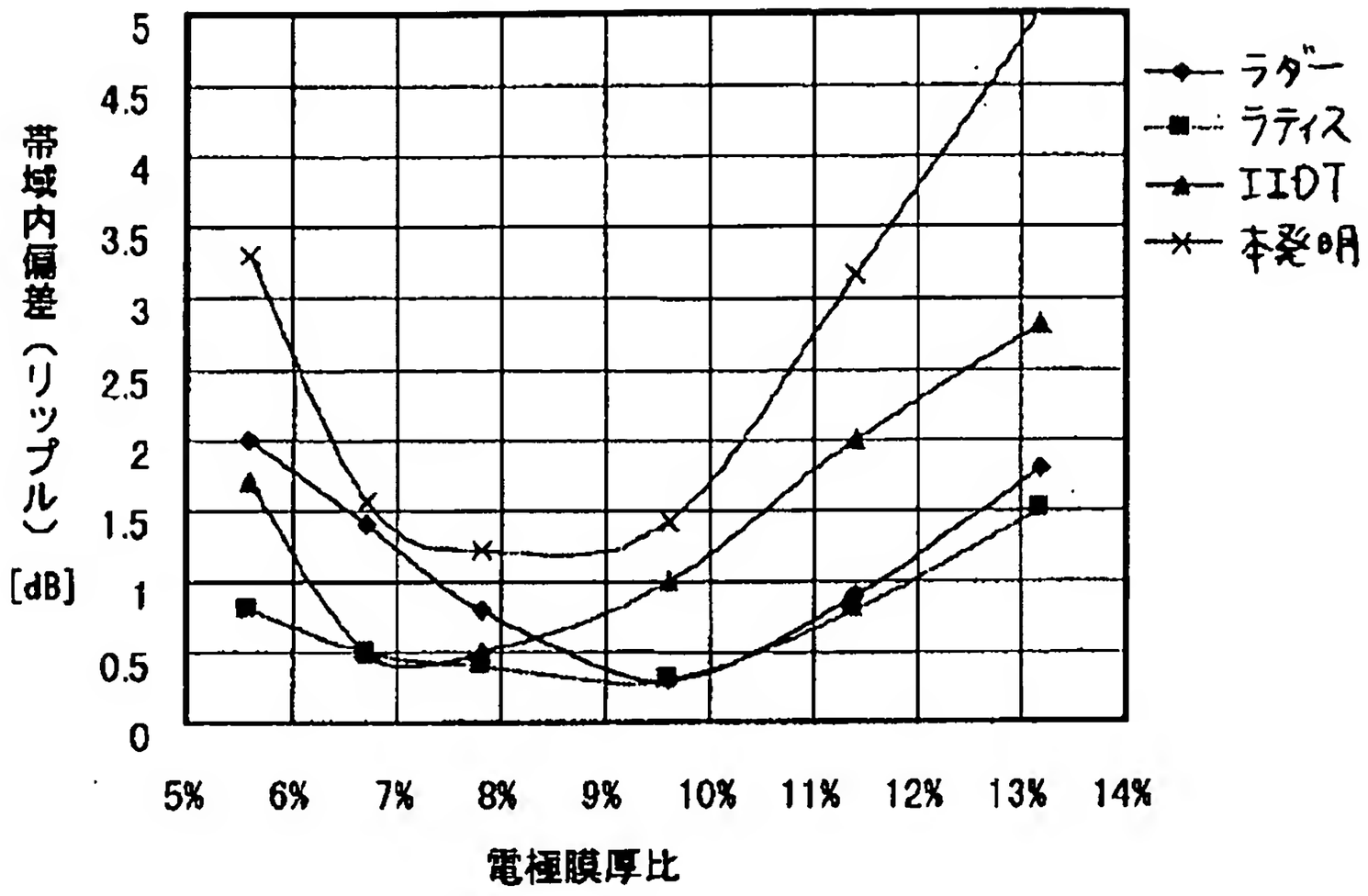
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]